A Two-Level Preconditioned Helmholtz–Jacobi–Davidson Method for the Maxwell Eigenvalue Problem

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Abstract: In this talk, based on a domain decomposition (DD) method, we propose an efficient two-level preconditioned Helmholtz–Jacobi–Davidson (PHJD) method for solving the algebraic eigenvalue problem resulting from the edge element approximation of the Maxwell eigenvalue problem. In order to eliminate the components in orthogonal complement space of the eigenvalue, we shall solve a parallel preconditioned system and a Helmholtz projection system together in fine space. After one coarse space correction in each iteration and minimizing the Rayleigh quotient in a small dimensional Davidson space, we finally get the error reduction of this two-level PHJD method as $c(H)\left(1 - C\frac{\delta^2}{H^2}\right)$, where C is a constant independent of the mesh size h and the diameter of subdomains H, δ is the overlapping size among the subdomains, and $c(H)$ decreasing monotonically to 1 as $H \to 0$, which means the greater the number of subdomains, the better the convergence rate. Numerical results supporting our theory are given.